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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/745,705	12/21/2000	Lawrence D. Wong	42390P9859	9709

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EXAMINER

VU, HUNG K

ART UNIT PAPER NUMBER

2811

DATE MAILED: 01/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/745,705

Applicant(s)

WONG, LAWRENCE D.

Examiner

Hung K. Vu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 11-26 is/are pending in the application.
- 4a) Of the above claim(s) 11-23 and 25 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24 and 26 is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 14 6) ☐ Other:

DETAILED ACTION

Request for Continued Examination

1 A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/14/02 has been entered. An action on the RCE follows.

Claim Objections

2. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

Misnumbered claim 25 been renumbered 26.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1, 2, 4-5, 7 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by

Gnade et al. (PN 5,470,802).

Gnade et al. discloses, as shown in Figures 8A-8D, a process comprising,

forming a first dielectric layer (58) on a substrate (22), wherein the first dielectric layer has a dielectric constant;

patterning the first dielectric layer such that a plurality of vertically oriented posts (58) are formed, the post having a top surface;

forming a second dielectric layer (28) over and adjacent to the posts, the second dielectric layer having a top surface and substantially filling up the area adjacent to the posts, wherein the second dielectric layer has a dielectric constant, the dielectric constant of the first layer being higher than the dielectric constant of the second layer;

wherein the plurality of vertically oriented posts are used to provide mechanical reinforcement of the second dielectric layer which make up the bulk of an inter-layer dielectric material;

polishing the second dielectric layer such that its top surface is substantially even with the top surfaces of the posts; (Note Col. 8, lines 14-23, Gnade et al. teaches mechanical polisher can be used.)

forming an inlaid metal interconnection (24) in the second dielectric layer.

With regard to claim 2, Gnade et al. discloses the substrate comprises a dielectric material.

(Note the table)

With regard to claim 4, Gnade et al. discloses the process further comprising curing the second dielectric layer. (Note Col. 4, lines 45-53 and Col. 6, lines 61-64)

With regard to claim 5, Gnade et al. discloses the process further comprising aging the second dielectric layer. (Note Col. 6, lines 61-64)

With regard to claim 7, Gnade et al. discloses forming the first dielectric layer comprises depositing an oxide of silicon. (Note the table)

With regard to claim 9, Gnade et al. discloses forming the second dielectric layer comprises spinning on a low-k material. (Note Col 6, lines 44-47)

3. Claims 1-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Wong (PN 6,432,811).

Wong discloses, as shown in Figure 10, a process comprising,

forming a first dielectric layer (108) on a substrate (101,102), wherein the first dielectric layer has a dielectric constant;

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patterning the first dielectric layer such that a plurality of vertically oriented posts (110) are formed, the post having a top surface;

forming a second dielectric layer (112) over and adjacent to the posts, the second dielectric layer having a top surface and substantially filling up the area adjacent to the posts, wherein the second dielectric layer has a dielectric constant, the dielectric constant of the first layer being higher than the dielectric constant of the second layer;

wherein the plurality of vertically oriented posts are used to provide mechanical reinforcement of the second dielectric layer which make up the bulk of an inter-layer dielectric material;

polishing the second dielectric layer such that its top surface is substantially even with the top surfaces of the posts; (Note Col. 6, lines 47-51)

forming an inlaid metal interconnection (206) in the second dielectric layer.

With regard to claim 2, Wong discloses the substrate (102) comprises a dielectric material. (Note Col. 5, lines 38-44)

With regard to claim 3, Wong discloses the substrate (102) is a material selected from the group consisting of carbon doped oxides of silicon. (Note Col. 5, lines 38-44)

With regard to claim 4, Wong discloses the process further comprising curing the second dielectric layer. (Note Col. 6, lines 61-63)

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With regard to claim 5, Wong discloses the process further comprising aging the second dielectric layer. (Note Col. 6, lines 61-63)

With regard to claim 6, Wong discloses the process further comprising forming dual damascene openings in the second dielectric layer.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnade et al. (PN 5,470,802) in view of Lin (PN 6,297,554, of record)

With regard to claim 3, Gnade et al. discloses the substrate is an interlayer dielectric material. Gnade et al. does not disclose the interlayer dielectric material is selected from the group consisting of silicon carbide, silicon nitride, and carbon doped oxides of silicon. However, Lin discloses a substrate having interlayer dielectric material (54) selected from the group consisting of silicon carbide, silicon nitride, and carbon doped oxides of silicon. Note Col. 2, line 65 and Figure 8 of Lin. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the substrate of Gnade et al. having the dielectric material selected from the group consisting of silicon carbide, silicon nitride, and carbon doped oxides of

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silicon, such as taught by Lin in order to prevent a layer formed under the substrate from overetching.

With regard to claim 8, Gnade et al. discloses all of the claimed limitation except forming the second dielectric layer comprises chemical vapor deposition of a low-k material. However, Lin discloses forming a second dielectric layer (82) comprising chemical vapor deposition of a low-k material. Note Col. 3, lines 37-47 and Figure 8 of Lin. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the second dielectric layer of Gnade et al. comprising chemical vapor deposition of a low-k material, such as taught by Lin in order to form the second dielectric layer with the desire step coverage characteristics and thicknesses.

Allowable Subject Matter

5. Claims 24-25 are allowed.

6. The following is an examiner's statement of reasons for allowance:

Applicant's claims 24-25 are allowable over the references of record because none of these references disclose or can be combined to yield the claimed invention such as the process comprising, depositing a silicon nitride layer on a wafer; depositing an insulating layer over the silicon nitride layer, wherein the insulating layer has a dielectric constant; patterning the insulating layer such that a plurality of structures are formed, the structures each having a top surface; depositing a porous dielectric material over and adjacent the structures, the porous

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dielectric material having a void fraction, wherein the porous dielectric material substantially fills out the area adjacent to the structures and wherein the porous dielectric material has a dielectric constant, the dielectric constant of the insulating layer being higher than the dielectric constant of the porous dielectric material; wherein the plurality of structures formed in the insulating layer provides mechanical reinforcement of the porous dielectric material which makes up the bulk of an inter-layer dielectric material; polishing the porous dielectric material such that a top surface thereof is substantially even with the top surfaces of the structures; after polishing the porous dielectric material, forming an inlaid metal interconnection in the porous dielectric material, as recited in claim 24.

Response to Arguments

7. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung K. Vu whose telephone number is (703) 308-4079. The examiner can normally be reached on Mon-Thurs 7:00-4:30 and every other Friday 7:00-3:30, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the

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organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Vu

January 24, 2003

Hung Vu